

Period Covered: January 1 through March 31, 2009 (Quarterly Report)

KSDOT Progress Report
for the

State Planning and Research Program

PROJECT TITLE: Construction of Crack-Free Concrete Bridge Decks, Phase II		
PROJECT MANAGER: Richard L. McReynolds, P.E.	Project No: TPF-5(174)	Project is: <input type="checkbox"/> PLANNING <input checked="" type="checkbox"/> RESEARCH & DEVELOPMENT
Annual Budget	Multi Year Project Budget \$975,000	

PROGRESS:

CONSTRUCTION ACTIVITIES:

KU began discussions with KDOT regarding the selection of LC-HPC bridges to be built in Phase II. A preliminary list was agreed upon, and more bridges will be evaluated in the coming months.

LAB ACTIVITIES:

A method for vacuum saturating lightweight aggregates to maximize the quantity of water absorbed was determined. A series of specimens designed to evaluate the effects of internal curing using saturated lightweight aggregate on free shrinkage were cast. The series included one mix containing limestone and three containing granite, the latter with different quantities of lightweight aggregate (0%, 9%, 12%, and 15% by volume of aggregate). Each batch had a cement content of 540 lb/yd³ and a water-cement ratio of 0.44. Curing periods of 7 and 14 days used.

Another series evaluating the combined effects of internal curing using lightweight aggregate and a mineral admixture [Grade 100 granulated ground blast furnace slag (GGBFS)] on free shrinkage are being cast. The series will include a granite control mix, lightweight aggregate and a 30% cement replacement with GGBFS, lightweight aggregate and 60% GGBFS, a limestone control, limestone and 30% GGBFS, and limestone and 60% GGBFS. Every batch will have a cement content of 540 lb/yd³ and a water-cement ratio of 0.44. The free shrinkage series are being evaluated using 7 and 14-day curing periods.

Restrained shrinkage (ring) specimens with a concrete thickness of 2 in. were cast this quarter. The batches included a concrete mix with a cement content of 535 lb/yd³ and a water-cement ratio of 0.45 and a concrete mix with a cement content of 540 lb/yd³ and a water-cement ratio of 0.44. The specimens will be cured for 14 days and then placed in an environment having a humidity range of 35 ± 4% and a temperature range of 70 ± 3°F (compared with standard environment used in previous tests that has a humidity range of 50 ± 4% and a temperature range of 70 ± 3°F). The effect of the drying environment on the time to cracking, as well as the sensitivity of the instrumentation to detecting the first crack, will be evaluated.

Scaling and freeze-thaw evaluation of the combined effects of a Class F fly ash and a shrinkage reducing admixture (SRA) on concrete durability have been delayed due to equipment improvements and will be cast during next quarter.

LAB RESULTS

The scaling evaluation of the SRA series for Phase I, performed in accordance with the Canadian standard test BNQ 2621-900/2002 Annex B, was completed. This test is used in place of ASTM C672 because it has been shown to provide a more realistic match with field performance. After 56 cycles, the test specimens exhibited increasing mass loss with increasing SRA dosage (average losses of 0.19, 0.40 and 1.11 kg/m², respectively, for 0%, 0.5% and 1% SRA content by weight of cement). All three mixes, however, had losses below the maximum allowable value of 1.5 kg/m². (Note: These results represent efforts under both Phase I and II of this project.

ACTIVITIES PLANNED FOR NEXT QUARTER

A series of scaling and freeze-thaw specimens will be cast to evaluate the combined effects of Class F fly ash and an SRA on concrete durability. Samples of the hardened concrete from this series will be evaluated with an air void analyzer by the Kansas Department of Transportation and in accordance with ASTM C457 "Test Method for Microscopical Determination of Parameters of Air-Void System in Hardened Concrete." Freeze-thaw evaluation will be performed in accordance to ASTM C666 "Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing – Procedure A".

KU will continue to work with KDOT to schedule LC-HPC bridge decks for Phase II of the project.

Project Personnel: David Darwin (Principal Investigator), JoAnn Browning (Co-Principal Investigator)

STATUS AND COMPLETION DATE

Percentage of work completed to date for total project is: 15%

 X on schedule behind schedule, explain:

Expected Completion Date: June 30, 2013